Please cancel claims 3 and 4, without prejudice.

Please add new claim 5 as follows:

5.   (New) A method as claimed in claim 1, wherein said exhaust gas is exhausted from a boiler.

A marked up copy of the amended material is attached hereto as required by 37 C.F.R. §1.121.

REMARKS

The Office Action dated October 16, 2002 has been received and carefully noted. The above amendments to the claims and the following remarks are submitted as a full and complete response thereto. Claims 1 and 2 have been amended. In addition, claims 3 and 4 have been cancelled and Claim 5 has been added. No new matter has been added or amendments made which narrow the scope of any elements of any claims. Accordingly, Claims 1-2 and 5 are pending in this application and are submitted for consideration.

Claims 1 and 2 were again rejected under 35 U.S.C. § 103(a) as being unpatentable over JP 11-290,643, in view of pages 14-13 and 18-31 in the Chemical Engineers Handbook (5th Ed.) edited by Perry et. al. The Office Action admits that that the present invention uses a packed column while JP-643 uses a plate column, and that the packing height in the tower ranges from 0.5 to 4 meters. To make up for this deficiency, the Office Action cites page 14-13 in the Chemical Engineer's Handbook for the proposition that the packed columns offer an economic advantage for small columns where the diameter of the column is less than 2 feet. Therefore, it was asserted that it would have been obvious to one skilled in the art to modify the process in JP-643 by

substituting a packed column for a plate column in order to arrive at the present invention. Applicant respectfully, but most strenuously, traverses this rejection.

As is clear from amended Claim 1, the essence of the present invention resides in the removal of acidic components from an exhaust gas (e.g., a boiler exhaust gas) containing the same by contacting the exhaust gas with seawater using an absorption gas provided with both a perforated plate and a packed filler under the specified condition, wherein the used seawater can be directly discharged to the ocean after oxidizing with air and mixing with raw seawater, without the use of any chemicals. This is completely absent in JP-643 and there is no suggestion to modify JP-643 in view of the Chemical Engineer's handbook.

In addition, JP-643 neither teaches the use of the present absorption column (i.e., a perforated plate column + a packed column) nor the discharge of the used seawater to the ocean, without using any chemicals, after the oxidation with air and the mixing with raw seawater. JP-643 uses a plate column for the treatment of an exhaust gas and also uses sodium hydroxide for the discharge of the used seawater to the sea.

Further, the Chemical Engineer's Handbook neither teaches the use of the present absorption column composed of a combination of a perforated plate column and a packed column, nor the use thereof under the specified conditions as defined in Claim 1. In addition, neither the use of the seawater for the treatment of the exhaust gas, nor the release of the used seawater to the ocean without use of chemicals is taught by this reference.

As such, there is no suggestion in the art to use the Chemical Engineers Handbook to modify the primary reference to arrive at the present invention.

Consequently, the present invention would not have been obvious to one of ordinary skill in the art.
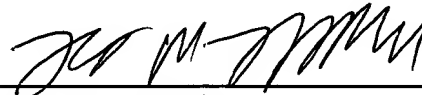
The Office Action also references U.S. Patent No. 5,690,899 (Makkinejad, et al.) in response to Applicant's argument that JP-643 does not teach or suggest the second contact with raw seawater after oxidation. However, the '899 patent also does not teach the use of the present absorption, nor the use thereof under the specified conditions as defined by the present invention. In addition, the '899 patent does not suggest the release of the used seawater to the ocean without use of chemicals as is disclosed by the present invention.

In view of the above remarks, the Applicant respectfully submits that each of Claims 1-2 and 5 recite subject matter which is neither disclosed nor suggested in the cited prior art. Applicant submits that this subject matter is more than sufficient to render the claimed invention unobvious to a person of ordinary skill in the art. Applicant therefore requests that each of the pending claims be found allowable, and this application be passed to issue.

If for any reason the Examiner determines that the application is not now in condition for allowance, it is respectfully requested that the Examiner contact, by telephone, the Applicant's undersigned attorney at the indicated telephone number.

In the event this paper is not timely filed, the Applicant respectfully petitions for an appropriate extension of time. Any fees for such an extension together with any additional fees may be charged to Counsel's Deposit Account No. 01-2300.

Respectfully submitted,

Leo M. Loughlin
Registration No. 42,811

ARENT FOX KINTNER PLOTKIN & KAHN, PLLC
1050 Connecticut Avenue, N.W.,
Suite 400
Washington, D.C. 20036-5339
Tel: (202) 857-6000
Fax: (202) 638-4810

MARKED-UP COPY OF CLAIMS

1.　　(Twice Amended) A method for removing an acidic component contained in an exhaust gas comprising:

　　(a)　　introducing raw seawater into a gas-liquid contact apparatus composed of an absorption column provided internally with at least one perforated plate at the top, bottom, or both top and bottom of the absorption column packed with at least one type of fillers to thereby effect an exhaust gas-seawater counter current contact treatment,

　　(b)　　oxidizing the seawater after the gas-liquid contact with air in an oxidation apparatus, and

　　(c)　　mixing raw seawater with the <u>oxidized</u> seawater, whereby the exhaust gas and the oxidized seawater are discharged[.]<u>, without using chemicals, to the ocean, wherein the seawater s introduced into a gas-liquid contact apparatus including an absorption column having a column diameter of at least one perforated plate having an free-space ration Fc of 0.25 to 0.5 and packed with at least one type of packing material to a packing height of 0.5m to 4m, in such an amount that a ratio L/G of the flow rate L (kg/m^2 • hr) of the seawater to the flow rate G (kg/m^2 • hr) of the gas to be treated from the top of the column is at least 3.6 and a flow rate L of the seawater is 1 x 10^4 to 25 x 10^4 kg/M^2 • hr and introducing a treated gas in such an amount that a range of a superficial gas velocity Ug in the apparatus from the bottom of the gas-liquid contact apparatus is less than 2 Ugm (m/sec);</u>

$$\underline{Ugm = 49.14 \ Fc^{G.7}(\rho_G/\rho_L \times 10^{-3})^{-0.5} \cdot (L/G)^{-1/3} \cdot \sqrt{g \cdot L}}$$

wherein L is a capillary constant $\sqrt{2\sigma/\rho^L \cdot g}$

g is a gravitational acceleration (m/sec^2), and

o is a surface tension of seawater (kg/sec^2)

in the case of using a perforated or grid plate column without weir and downcomer composed of at least one perforated plate and the ratio ρ_G/ρ_L of the density ρ^G (kg/m^3) of the treated gas to the density ρ_L (kg/m^3) of seawater is at least 0.838 x 10^{-3}.

2.   (Twice Amended) A method as claimed in claim 1, wherein the free-space ratio Fc is 0.3 to 0.4 and the ratio L/G is 7 to 25. [whereby the seawater is introduced into a gas-liquid contact apparatus including an absorption column having a column diameter of at least 500 mm and provided with at least one perforated plate having an free-space ratio Fc of 0.25 to 0.5 and packed with at least one type of packing material to a packing height of 0.5 m to 4 m, in such an amount that a ratio L/G of the flow rate L (kg/m^2·hr) of the seawater to the flow rate G (kg/m^2·hr) of the gas to be treated from the top of the column is at least 3.6 and a flow rate L of the seawater is 1 x 10^4 to 25 x 10^4 kg/M^2·hr and introducing a treated gas in such an amount that a range of a superficial gas velocity Ug in the apparatus from the bottom of the gas-liquid contact apparatus is less than 2 Ugm (m/sec):

in the case of using a perforated or grid plate column without weir and downcomer composed of at least one perforated plate and the ratio ρ_G/ρ_L of the density ρ_G (kg/m^3) of the treated gas to the density ρ_L (kg/m^3) of seawater is at least 0.838 x 10^{-3}

$$Ugm = 49.14 \ Fc^{0.7} \left(\rho_G / \rho_L \times 10^{-3} \right)^{-0.5} \bullet (L/G)^{-1/3} \bullet \sqrt{g \cdot L}$$

wherein L is a capillary constant $\sqrt{2\sigma / \rho_L \cdot g}$,

g is a gravitational acceleration (m/sec^2), and

σ is a surface tension of seawater (kg/sec^2)]

5.   (New) A method as claimed in claim 1, wherein said exhaust gas is exhausted from a boiler.

(09/699,373)